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ABSTRACT

This unit of instruction on insulation, caulking, and weatherstripping homes was designed for use by home economic teachers in Florida high schools and by home economics extension agents as they work with their clientele. It is one of a series of 11 instructional units (see note) written to help teachers and agents to educate their students and clients about the problems of energy shortages and strategies for energy conservation and management. Topics covered in this unit include the purpose and results of proper insulation; four methods of insulating a house; advantages and disadvantages of various types of insulation materials; R values; how to insulate a house; cost of installing insulation; and materials and methods used in caulking and weatherstripping. The unit contains student performance objectives, content information, teaching-learning activities, student handouts, transparency masters, and evaluation instruments. (KC)

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LOW ENERGY TECHNOLOGY
A UNIT OF INSTRUCTION
IN
HOUSING AND HOME ENVIRONMENT

INSULATION, CAULKING & WEATHERSTRIPPING

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Developed by

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Department of Agricultural and Extension Education
Department of Home Economics
Institute of Food and Agricultural Sciences
University of Florida
Gainesville

1980

This public document was promulgated at a cost of $ 1010.50, or $ 13 cent per copy to inform Agribusiness and Natural Resources teachers in Florida of the products and services of the Instructional Materials Service.

This unit of instruction was developed as a part of the Low Energy Technology Program of the Institute of Food and Agricultural Sciences, University of Florida. Additional copies of this and other units of instruction in Low Energy Technology can be obtained by contacting the Instructional Materials Service, 101 Rolfs Hall, University of Florida, Gainesville, Florida 32611.

CE 030 823

INTRODUCTION

As homeowners' energy bills rapidly escalate, they will find themselves allocating more of their income to cover heating and cooling requirements, which were once considered a minor expense of operating a house. Although Florida does not experience severe, prolonged cold weather as many other states do, extremes of very humid, hot summers to a significant drop in temperature in winters can produce real difficulties in designing a house that is liveable in both extremes.

In most homes, the lack of adequate insulation is the greatest cause of energy waste. Without adequate insulation, energy costs are higher because cooling and heating equipment must work overtime to provide comfort. Adding insulation increases the value of your home and saves money and fuel, year after year. Insulation can be expected to pay for itself in a few years through fuel savings, especially since fuel costs continue to rise.

This unit of instruction on Insulation includes seven student performance objectives, upon completion of this unit, the student will be able to:

1. Explain the purpose of insulation and the results of proper insulation.
2. List and briefly describe four methods which can be used to insulate a house.
3. Identify three common types and four different insulation materials. Indicate how each is used and give an advantage and disadvantage of each.
4. Calculate the R-value of a ceiling, wall, or floor, given a table of R-values.
5. Find out how a structure is insulated.
6. Calculate the cost of installing insulation.
7. Describe the importance of weatherstripping and caulking. Identify materials used and demonstrate how to use materials.

This unit of instruction includes student performance objectives, content information, teaching-learning activities, student handouts, transparency masters and evaluation instruments. Use a copy machine to reproduce the student handouts and make the transparencies.

This unit of instruction was designed for use by home economics teachers in Florida high schools and by extension home economic agents as they work with youth and adults. It would be appropriate for use by any professional home economist as they work with their clients. This unit of instruction was developed by the Department of Agricultural and Extension Education and Department of Home Economics, Institute of Food and Agricultural Sciences as part of the Low Energy Technology Program.

UNIT: HOUSING

LOW ENERGY TECHNOLOGY
HOUSING AND HOME ENVIRONMENT

MODULE: INSULATION, CAULKING & WEATHERSTRIPPING

STUDENT PERFORMANCE OBJECTIVES	CONTENT	TEACHING-LEARNING ACTIVITIES
The student will be able to:		
1. Explain the purpose of insulation and the results of proper insulation.	Purposes of insulation: Prevent heat from entering in summer Prevent heat from escaping in winter Prevent cool air from entering in winter Prevent cool air from escaping in summer Results of proper insulation: Reduced use of energy for heating and cooling More comfort to family Increased value of home Smaller heating/cooling unit(s) needed	Discuss: What is insulation? Give examples not related to housing. Wearing a sweater or coat. Using a hot pad. Discuss: What is home insulation? Why is it important? Conduct demonstration. Handout: "What's the Best Insulator?"
2. List and briefly describe four methods which can be used to help make a house energy efficient.	Ways to help increase energy efficiency: Landscaping, use of shade Positioning of house, window exposure Use of insulation,construction materials and methods Weatherstripping and caulking	
3. Identify three common types and four different insulation materials. Indicate how each is used and give an advantage and disadvantage of each.	Three common types: Batts and blankets - with or without vapor barrier Loose fill Rigid board	Read: "Saving Energy with Insulation' Transparency: "Insulation Types". Have students collect samples of insulation materials from building suppliers.

STUDENT PERFORMANCE OBJECTIVES	CONTENT	TEACHING-LEARNING ACTIVITIES
	Four different materials: fiberglass rockwood cellulose fiber plastic (polystyrene - polyurethane)	Arrange a field trip to a home building site to observe insulation materials being installed.
4. Calculate the R-value of a ceiling, wall or floor given a table of R-values.	R-value - the resistance a material presents to heat passing through it. Recommended R-values: Ceiling R-26 - R-30 (Minimum R-19) Outside walls R-11 - R-13 Floors R-9 - R-11	Review demonstration "What's the best Insulation?" Review "Saving Energy with Insulation". Discuss: Why a higher R-value for ceilings? Heat rises. Handout: "R-value of Structural & Finish Materials". Handout: "Problems in Calculating R-value". Complete problems. Have students calculate the R-value for their home.
5. Find out how a structure is insulated.	The easy way to insulate is to install the insulation at the time of construction. The problem is to insulate existing structures which need insulation.	Construct a partial wall, ceiling or floor panel. Demonstrate proper installation of insulation.

STUDENT PERFORMANCE OBJECTIVES	CONTENT	TEACHING-LEARNING ACTIVITIES
	Existing walls. Difficult or impossible for most homeowners. Insulation is normally blown in by professional installers with specialized equipment. Vapor barrier <u>always</u> next to the inside living space. walls - inside ceilings - down floors - up Check the fire resistance and toxic fume characteristics of insulation materials. Do not use in unrecommended locations. Provide natural ventilation.	Read: "How to Insulate Your Floors" and "How to Insulate Your Unfinished Attic". Make arrangements to visit a site when a professional installer is insulating a home.
6. Calculate the cost of installing insulation.	Two costs: Costs of materials Costs of installation	Obtain costs of common materials. Have students contact different building supply outlets for prices. Calculate amount needed for 30' x 40' house. See page two of "How to Insulate Your Unfinished Attic". 30' x 40' x .9 or .94 = square feet needed.
7. Describe the importance of weatherstripping and caulking, identify materials used and demonstrate how to use materials.	Check doors - windows. Best to check on windy day when there is a 20°F difference between outdoor and inside temperatures.	Conduct an air leakage inspection of your home. Report findings to class.

STUDENT PERFORMANCE OBJECTIVES	CONTENT	TEACHING-LEARNING ACTIVITIES
	Weatherstripping. Consider cost, ease of installation, durability and appearance. Caulking. Consider cost, ease of installation, adherence to materials, durability and appearance. Storm windows and doors. Cost is normally not justified on well constructed homes with well fitted doors and windows. Recommended use of plastic over poor fitting windows in older homes. Creates a dead air space.	Collect samples and prices of weatherstripping and caulking materials from building supply business. Read: "Weatherstripping and Caulking to Save Energy".

WHAT'S THE BEST HANDOUT INSULATOR ?

MATERIALS:

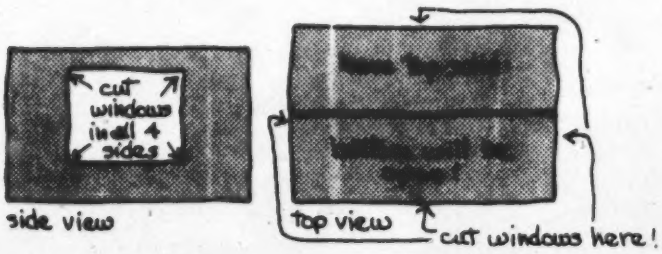
100 Watt bulb in ceramic socket - see drawing

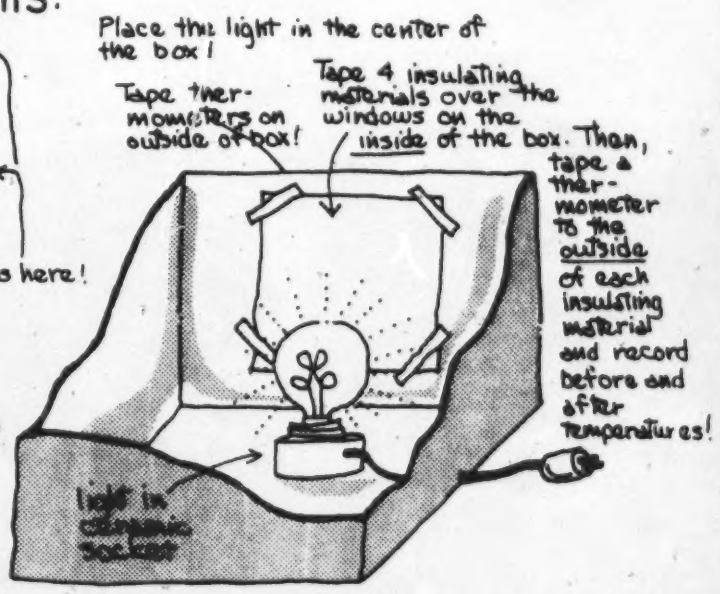
A variety of insulating and non-insulating materials such as wood, aluminum foil, fiberglass (3" or 4"), glass, metal, newspaper, heavy cloth, etc.

4 Thermometers, cardboard box, watch

Masking tape

Set up the box like this:




Place the light in the center of the box!
Tape thermometers on outside of box!
Tape 4 insulating materials over the windows on the inside of the box. Then, tape a thermometer to the outside of each insulating material and record before and after temperatures!
light in ceramic socket

Turn the lamp on for 5 minutes. Record the rise in temperature for each material.

How much better is the best insulator compared to the worst? Record your results.

Stretch America's Vanishing Energy

FLORIDA COOPERATIVE EXTENSION SERVICE

Saving Energy with Insulation

Faye T. Plowman, Assistant Professor / Housing Specialist

ENERGY CONSERVATION FACT SHEET

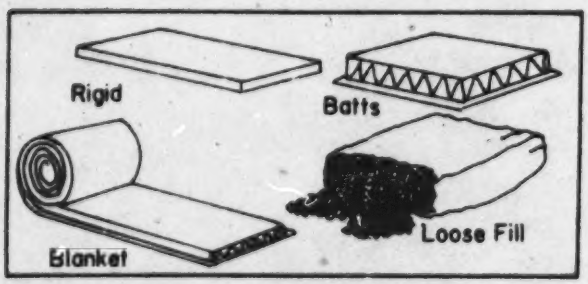
University of Florida • Institute of Food and Agricultural Sciences

Home insulation is one way to combat the ever-increasing cost of energy. Properly installed insulation pays for itself in a very short time by permanently decreasing the energy waste created by your home's heating and cooling system, thus lowering your fuel bills. It also adds to the value of your property.

In the winter, a badly insulated home lets heat escape to the outdoors—and you pay for it. In the summer, a poorly insulated home lets heat in, causing your air conditioner to work harder, boosting your power bills. Besides helping to eliminate energy waste, adequate insulation makes it possible to use smaller-capacity air conditioning equipment, requiring less power. Even if your home does not have air conditioning, insulation will shut out heat and make your home more comfortable.

The information in this fact sheet discusses home insulation in states with warm climates, such as Florida.

TYPES OF INSULATION



The three most common types of home insulation are batts or blankets, loose fill and rigid boards.

Batts and Blankets

Batt and blanket insulation is normally used during initial construction. However, it is excellent for insulating unfinished attic floors and rafters or the underside of floors.

Both batts and blankets are made of fiberglass or rock wool and come with or without vapor barrier backing. Batt insulation is available in panels which are 1 inch to 7 inches thick, 15 inches or 23 inches wide, and 4 feet or 8 feet long. Blanket insulation is available in the same widths and thicknesses, but it comes in rolls to be cut by the installer.

The most common batt and blanket insulation is 3½ inches, 6 inches, or 6½ inches thick. Although both come in widths to fit neatly between studs, rafters, and joists with standard 16 inch or 24 inch spacing, the batts and blankets are easily cut to fit all other spacing.

Loose Fill

Loose fill insulation consists of tufts of fiberglass, rock wool, or cellulosic fiber. It is usually blown or poured into either a finished or unfinished attic and sometimes into finished side walls. For do-it-yourself installation, it is available in packaged bags.

Loose fill insulation is especially good for filling irregular spaces. When used for attic insulation, it will cover ceiling supports and provide more uniform insulation than batts or blankets. When used inside walls, be sure to fill all spaces. Batt or blanket insulation is recommended for new walls, because loose fill will settle over a period of years.

Rigid Board

Rigid board insulation is made of fiberglass or plastic (polystyrene and polyurethane) or other ma-

COOPERATIVE EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS, STATE OF FLORIDA, IFAS, UNIVERSITY OF FLORIDA, U. S. DEPARTMENT OF AGRICULTURE, AND BOARDS OF COUNTY COMMISSIONERS, COOPERATING

terials. It comes in 24 inch or 48 inch widths with a variety of thicknesses from ¾ inch to 4 inches. This type of insulation has a high insulating value for relatively small thicknesses. Although it has many uses, it is particularly suitable for basement wall insulation or for load-bearing areas. Polystyrene or urethane rigid board insulation should be installed only by a contractor and covered with gypsum wallboard to assure fire safety.

INSULATION R-VALVE

R-Value is a number that tells how much resistance the insulation presents to heat passing through it. The higher the R-Value, the better the insulation.

For maximum comfort and lowest cooling and heating bills, the following R-Values are recommended:

Ceiling	R-26 to R-30
Outside walls	R-11 to R-13
Floors over unheated spaces	R-9 to R-11

Use Table 1 to find out how thick the insulation you buy should be to achieve the desired R-Value.

Table 1. R-Value/Insulation Thickness

	TYPE OF INSULATION					
	Batts or Blankets		Loose Fill (Poured-in)			
R-VALUE	fiber-glass	rock wool	fiber-glass	rock wool	cellulosic fiber	
R-11	3½"-4"	3"	5"	4"	3"	R-11
R-19	6"-6½"	5¼"	8"-9"	6"-7"	5"	R-19
R-22	6½"	6"	10"	7"-8"	6"	R-22
R-30	9½"-10½"*	9"*	13"-14"	10"-11"	8"	R-30

* Two batts or blankets required

ATTIC INSULATION

Although attic insulation helps reduce both heating and cooling costs, it is extremely important in warm climates. In the summer, your attic temperatures may rise as high as 140° F., which greatly increases your home's cooling load. If you add 6 inches of insulation to an attic that has none, you will substantially reduce your air conditioning bill.

However, 6 inches of insulation (R-19) should be considered the minimum for proper attic insulation. The recommended R-Values of R-26 to R-30 are achieved with 8-10 inches of fiberglass insulation or the equivalent. The initial investment will pay for itself in lower fuel costs in three to four years or less.

To insulate an attic floor where there is no insulation, lay batts or blankets between the joists. If some insulation already exists, take care to use new insulation which does not have a vapor barrier. Work from the outer edges of the attic toward the center where there is headroom for easier cutting and fitting. If you do not wish to use batts or blankets, you can easily pour loose fill insulation out of the bag, and then level it with a rake or a short piece of board.

Installing Attic Insulation

Installation Tips

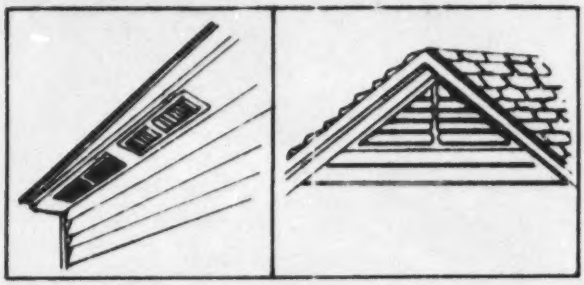
- Don't insulate on top of recessed lighting fixtures, motors and other heat-producing equipment that protrudes through the attic floor. Improvise a way to hold the insulation 3 inches away from the sides of the protrusion.
- Hand-pack insulation around pipes and electrical cables passing through the attic floor.
- Stuff openings around interior chimneys.
- Insulate the exposed ducts of heating and cooling systems.
- Remember to insulate the top of the attic trapdoor, and make sure the trap-door seals tightly when closed.

VENTILATION

Your attic must be adequately ventilated all year round for attic insulation to function properly. In winter, the insulation keeps heat inside the living space below, while the open vents let unwanted moisture vapor escape before it can condense in your attic. In summer, the moving air helps cool your attic which lessens the cooling load.

For proper ventilation, have a carpenter install louvers in the eaves and gables. The total open area of the louvers should be 1/300 of your attic area if your home does not have air conditioning or 1/150 of your attic area if your home does have air conditioning. The louvers should be evenly divided between gables and eaves for best circulation.

Be careful not to block ventilation paths with insulation.



Eave Vent Gable Vent

VAPOR BARRIERS

A vapor barrier is a material that will not absorb moisture or let moisture pass through it. Commonly used materials are plastic film, metal foil, or asphalt between layers of brown paper.

It is important to note that for southern states, such as Florida, a vapor barrier is used primarily to reduce the amount of ventilation required. However, if you are insulating a finished attic, install a vapor barrier toward the living space. With other attics, vapor barriers are optional and probably unnecessary if you have adequate attic ventilation.

If it is necessary for you to use vapor barriers, be sure to install them on the side toward the living space.

Never place insulation which has an attached vapor barrier over insulation already in place.

WALL INSULATION

Walls should have a minimum of 3½ inches of fiberglass insulation or the equivalent.

To insulate an unfinished wall, fit the end of blanket insulation snugly against the top piece of framing. Working down, staple the blanket to the studs at 8-inch intervals and cut it to fit tightly against the bottom framing.

Insulating finished walls is not really a do-it-yourself job. Special pneumatic equipment is needed to place loose insulation into wall cavities. A professional contractor has the skill and tools to do it properly.

STORM WINDOWS

Storm windows reduce air leakage which helps conserve heating and cooling energy. In southern states with relatively mild winters, such as Florida, glass storm windows at their present price will not pay for themselves in energy savings. However, plastic storm windows are effective and economical, especially if you install them yourself.

For further information, contact your County Extension Office.

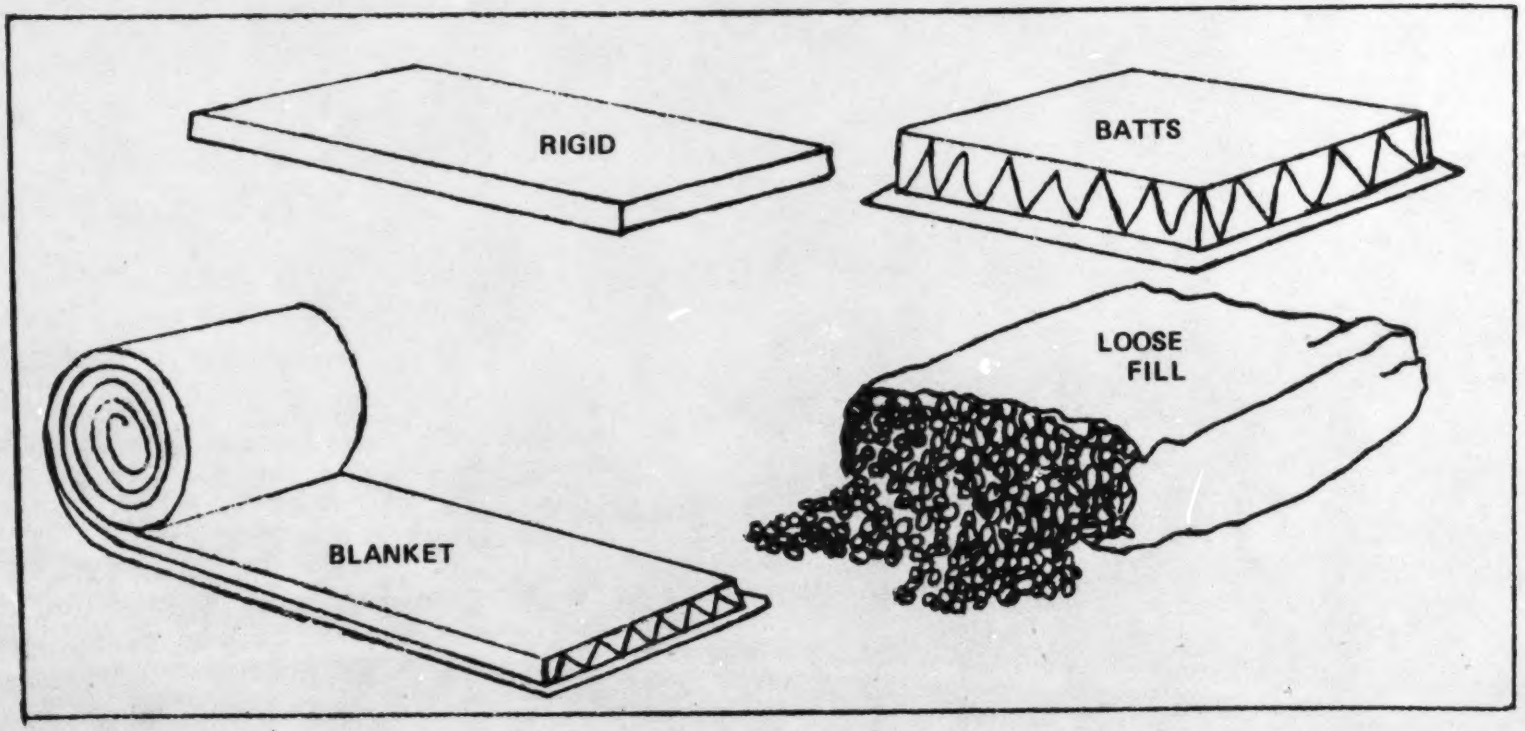
REFERENCES

Complete Do-it-yourself Manual. The Reader's Digest Association. Pleasantville, New York, 1973.

How To Save Money By Insulating Your Home. National Mineral Wool Insulation Association, Inc. Summit, New Jersey. 1976.

In the Bank—Or Up the Chimney? Division of Energy, Building Technology, and Standards. U.S. Department of Housing and Urban Development. Washington, D.C., April 1975.

INSULATION TYPES



HANDOUT

AVERAGE R-VALUE OF STRUCTURAL AND FINISH MATERIALS

Wood siding shingles, 16:, 7 1/2" exposure	R-0.87
Asbestos-cement shingles	R-0.03
Stucco, per inch	R-0.02
Building paper	R-0.05
1/2" insul. board sheathing, regular density	R-1.32
25/32" insu. board sheathing, regular density	R-2.04
1/4" plywood	R-0.31
3/8" plywood	R-0.47
1/4" hardboard, paneling	R-0.62
Softwood board, 3/4" thick	R-0.94
Concrete blocks, three oval cores	
Cinder aggregate, 4" thick	R-1.11
Cinder aggregate, 8" thick	R-1.72
Sand and gravel aggregate, 8" thick	R-1.11
Lightweight aggregate (expanded clay, shale, slag, pumice, etc.), 8" thick	R-2.00
Common brick, per inch	R-0.20
Face brick, per inch	R-0.11
Sand-and-gravel concrete, per inch	R-0.08
Sand-and-gravel concrete, 8 inches thick	R-0.64
1/2" gypsumboard	R-0.45
5/8" gypsumboard	R-0.56
1/2" lightweight-aggregate gypsum plaster	R-0.32
25/32" hardwood finish flooring	R-0.68
Asphalt, linoleum, vinyl, or rubber floor tile	R-0.05
Carpet and fibrous pad	R-2.08
Carpet and foam rubber pad	R-1.23
Asphalt roof shingles	R-0.44
Wood roof shingles	R-0.94
3/8" built-up roof	R-0.33
Glass	
Single glass (winter) U=1.13	R-0.88
Single glass (summer) U=1.06	R-0.94
Insulating glass (double)	
1/4" air space (winter) U=0.65	R-1.54
1/4" air space (summer) U=0.61	R-1.64
1/2" air space (winter) U=0.58	R-1.72
1/2" air space (summer) U=0.56	R-1.79
Insulation	
2" -2 1/2" thick	R-7.00
3" -4" thick	R-11.00
5" -7" thick	R-19.00
Dead Air Space	R- 1.00

NAME_____

HANDOUT

PROBLEMS IN CALCULATING R-VALUES

This is a strange house. It is built with a number of different construction materials to give you experience in calculating R-Values. Using the Handout "Average R-Value of Structural and Finish Materials, calculate the following R-values.

1. The kitchen walls are made of 8" cinder block. What is the R-value of these walls?

2. The kitchen floor is over an open crawl space. The floor is made of softwood boards, covered with 3/8" plywood and asphalt tiles. What is the R-value of the floor?

3. The kitchen ceiling is 5/8" gypsum board on the underside, with a 3/8" build-up flat roof above. There is a dead air space between the ceiling and the roof. What is the R-value of the ceiling?

4. The bedroom walls have 1/2" insulated board sheathing covered with wood siding on the outside. On the inside the wall has 1/2" gypsumboard covered with 1/2" gypsum plaster. Between the outside and inside wall is 3" thick rock wood. What is the R-value of the wall?

5. The bedroom floor is like the kitchen floor except cayset and fibrous pad are laid over the asphalt and 4" fiberglass batts have been installed under the floor. What is the R-value of the floor?

6. The bedroom ceiling has the same inside construction as the wall. Naturally there is no outside wall, but 6" of loose fill cellulose fiber has been placed over the ceiling. What is the R-value of the ceiling?

7. In the den the original construction was like the kitchen but there have been some changes. The walls have been paneled They fastened 1"x 2" wood laths to the inside of the cider block and stapled 1/2" insulating board sheathing to the laths creating a dead air space. 1/4" hardboard paneling was fastened to the insulating board. What is the R-value of the den wall?

8. In the den, they dropped the ceiling 6", installed a 4" fiberglass blanket and ceiling tiles made of the same materials as the 1/2" insulated board sheathing. What is the R-value of the ceiling?

9. On the floor of the den, which had been like the kitchen, they just added a carpet with a foam rubber pad and installed 4" fiberglass batts under the floor as they did in the bedroom. What is the R-value of the floor?

10. Which of the kitchen, bedroom and den walls, floors and ceilings now have the recommended R-values?

HFS 301

Housing & Near Environment

How to Insulate Your Floors

EHE FACT SHEET

Florida Cooperative Extension Service / Institute of Food and Agricultural Sciences / University of Florida / John T. Woeste, Dean

For maximum comfort and lowest cooling and heating bills, insulation with an R-value of R-9 to R-11 is recommended in floors over unheated spaces.

Tools

1. Heavy duty shears or linoleum knife.
2. Temporary lighting with waterproof wiring and connectors.
3. Portable fan or blower to provide ventilation.
4. Tape measure.
5. Heavy duty staple gun and staples.

Safety Pointers

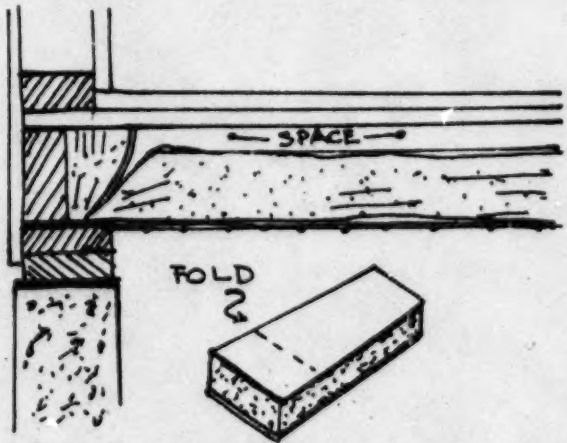
1. Provide adequate temporary lighting.
2. Wear gloves and breathing mask when working with fiberglass or rock wool.
3. Provide adequate ventilation.
4. Keep lights and all wires off wet ground.

Materials You'll Need

1. R-11 (3"-3½") batts or blankets of rock wool or fiberglass, preferably with foil facing.
2. Heavy gauge wires pointed at both ends and made especially for this purpose; OR wire for lacing back and forth between nails placed in bottom of joists; OR wire mesh or chicken wire of a convenient width for handling in a tight space.
3. If it is desirable to protect the insulation from the weather in such places as open crawl spaces, then nail standard, interior-grade softwood plywood, nail-base insulation board, or a similar covering to the bottom of the floor joists.

Installation

When insulating a vented and unheated crawl space, buy insulation with a vapor barrier and install it with the vapor barrier facing up (next to the living area). Be sure that ends of the batts fit snugly against the bottom of the floor to prevent heat loss.



Push the batts or blankets between the floor joists from below. To support the insulation follow one of these procedures:

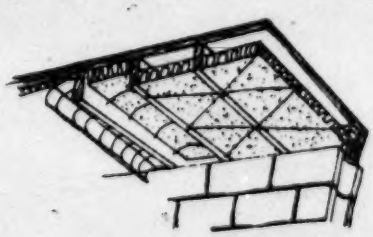
1. Bow the heavy-gauge wires and wedge them under insulation and between joists.

Or

2. Lace wire back and forth among nails spaced about 2 feet apart in the bottoms of the joists.

Or

3. Nail chicken wire to bottom of joists and, working in short sections, slide batts in on top of wire.



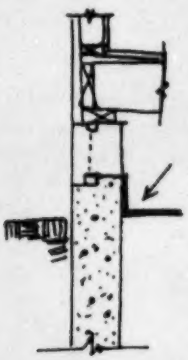
Ventilation

At least two vents, opposite each other, should be provided in an unheated crawl space.

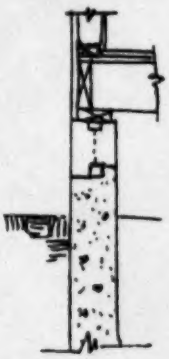
Basic minimum opening size (with a vapor barrier of 4-mil-or-thicker polyethylene sheeting or 55-lb. asphalt roll roofing lapped at least 3 inches) on the ground is 1 sq. ft. of vent for each 1,500 sq. ft. of crawl space area.

Four vents, one on each of the four sides, are recommended if vents are protected by screening or louvers.

w vapor barrier



w/out vapor barrier



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This publication was printed at a cost of $250.54, or 2.5 cents per copy, to inform homeowners on energy saving measures.

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COOPERATIVE EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS
(Acts of May 8 and June 30, 1914)
Cooperative Extension Service, IFAS, University of Florida
and United States Department of Agriculture, Cooperating
K. R. Tefertiller, Director

HFS 302

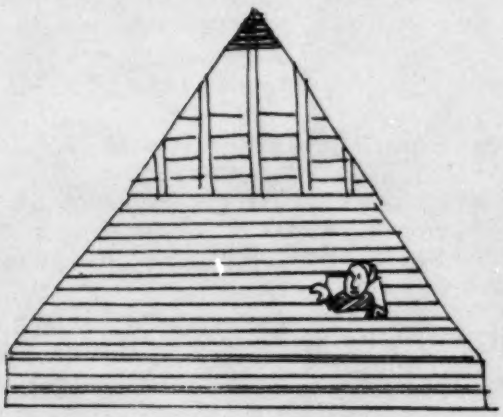
Housing & Near Environment

EHE FACT SHEET

How to Insulate Your Unfinished Attic

Faye T. Plowman

Florida Cooperative Extension Service / Institute of Food and Agricultural Sciences / University of Florida / John T. Woeste, Dean



For more information about the type of insulation to use and recommended R-values, see EC-9, Saving Energy With Insulation.

DO-IT-YOURSELF

To insulate your unfinished attic, you can:

1. Install batts or blankets between the joists or trusses.

Or

2. Pour in loose fill between the joists or trusses.

Or

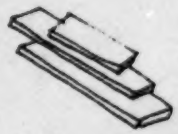
3. Lay in batts or pour in loose fill over existing insulation if you've decided you don't have enough already.

Don't add a vapor barrier if you're installing additional insulation.

Tools

1. Temporary lighting.

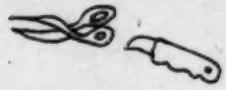
2. Temporary flooring.



3. Duct or masking tape (2" wide).

4. Heavy duty staple gun and staples, or hammer and tacks.

5. Heavy duty shears or linoleum knife to cut batts or blankets and plastic for vapor barrier.

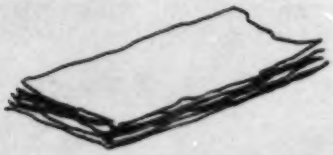


Safety Pointers

1. Provide good lighting.
2. Lay boards or plywood sheets over the tops of joists or trusses to form a walkway because the ceiling below won't support your weight.
3. Be careful of roofing nails protruding through roof sheathing.
4. If you use fiberglass or mineral wool, wear protective clothing and gloves, and wear a breathing mask. Keep the material wrapped until you're ready to put it in place.

Materials You'll Need

Batts—fiberglass or rock wool



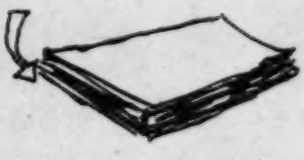
Or

Blankets—fiberglass or rock wool

Or

Loose fill—fiberglass, rock wool, or cellulosic fiber

Vapor barrier—attached to batts or blankets



Or

Four or six-mil polyethylene

How Much

1. Accurately determine the attic area by measuring the rooms directly underneath the roof. Then, measure the distance between the beams in the attic. This distance will be either 15 inches or 23 inches.

2. If the distance between the beams is 15 inches, multiply the area of your ceiling by .9 to find how many square feet of insulation you will need.

Insulation area X .9 = _____ square feet.

If the distance between the beams is 23 inches, multiply the ceiling area by .94 to find how many square feet of insulation you will need.

Insulation area X .94 = _____ square feet.

3. To determine insulation thickness, refer to **EC-9, Saving Energy With Insulation.**

4. Vapor barrier area.

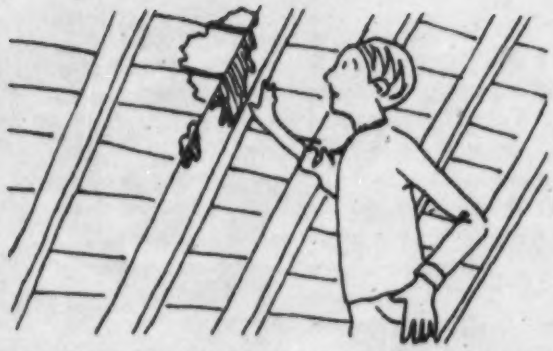
- For batts or blankets with vapor barrier backing, use insulation area.
- For polyethylene (for use with loose fill, or if backed batts or blankets are not available), use insulation area, but plan on waste because the polyethylene will be installed in strips between the joists or trusses and you may not be able to cut an even number of strips from a roll.

Installing the Insulation

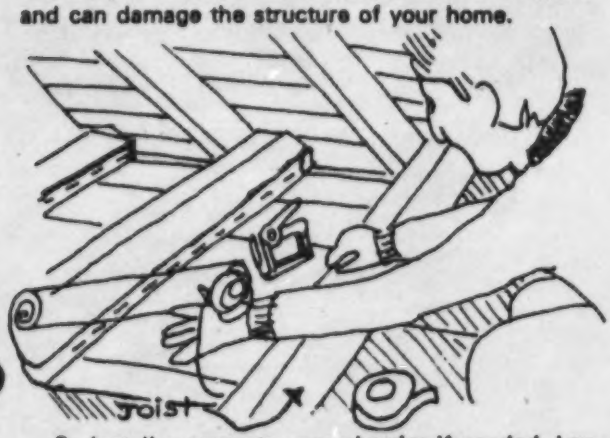
Preparation

Use temporary lighting and flooring, check for roof leaks and the need for ventilation and vapor barrier. Seal all places where pipes or wires penetrate the attic floor.

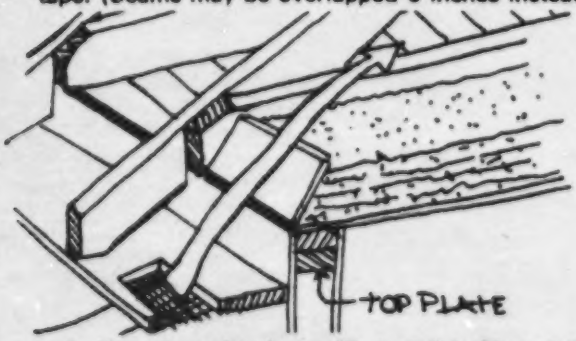
1. Install temporary flooring and lights. Keep insulation in wrappers until you are ready to install. Insulation comes wrapped in a compressed state and expands when the wrappers are removed.



2. Check for roof leaks by looking for water stains or marks. If you find leakage, make repairs before you insulate. Wet insulation is ineffective and can damage the structure of your home.



3. Install a separate vapor barrier if needed. Lay in polyethylene strips between joists or trusses. Staple or tack in place. Seal seams and holes with tape. (Seams may be overlapped 6 inches instead.)



4. If you're using loose fill, install baffles at the inside of the eave vents so that the insulation won't block the flow of air from the vents into the attic. Be sure that insulation extends out far enough to cover the top plate.

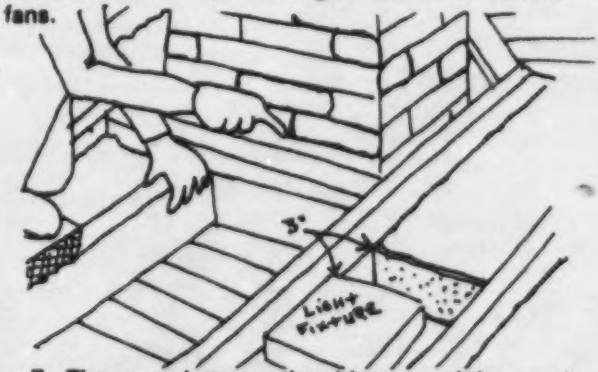
Installation

Either lay in batts or blankets between the joists or pour in loose fill. If you're using batts or blankets with a vapor barrier, place the barrier on the side toward the living area.

5. Lay in blankets or batts between joists and trusses. (Note: batts and blankets are slightly wider than joist spacing so they'll fit snugly). If blankets are used, cut long runs first to conserve material, using leftovers for shorter spaces. Slide insulation under wiring whenever possible.

Or

6. Pour in loose fill insulation between the joists up to the top of the joists. Use a board or a garden rake to level it. Fill all the nooks and crannies, but don't cover recessed light fixtures or exhaust fans.



7. The space between the chimney and the wood framing should be filled with noncombustible material, preferable unfaced batts or blankets. Also, the National Electric Code requires that insulation be kept 3 inches away from light fixtures.

8. Cut ends of batts or blankets to fit snugly around cross bracing. Cut the next batt in a similar way to allow the ends to butt tightly together.

Natural Ventilation

Install ventilation louvers (round or rectangular) under the eaves or at gable ends. Ridge vents are also available, but are more difficult and costly to install in your house. The total open area of these louvers should be 1/300 of your attic area, if your home does not have air conditioning, or 1/150 of your attic area if your home does have air conditioning. Where louvers are protected by screens, the area should be increased at least 1½ times.

Ventilation louvers should be installed by a carpenter unless you are an experienced handyman. **Don't block ventilation path with insulation.**

Attic Fan Ventilation

Attics may be ventilated by the use of permanently installed power fans or turbine ventilators with hot air exhausted through roof, gable or eave louvers. Fans should have the capacity to provide a minimum of 15 to 20 air changes per hour at .05 inches of static pressure. An attic thermostat should control the operation of the fan and should be set to turn on when the attic temperature rises above 95°F. Turbine roof ventilators may also be used but are not as dependable as power fans in providing the desired air exchange rate.

NOTE: With a well insulated attic (R-26 to R-30) and adequate louvers, power fans or roof turbines are not necessary. Also, you benefit from the additional insulation in the winter when power fans and roof turbines would not be needed.

REFERENCE: D. E. Buffington, Associate Professor Agricultural Engineering, University of Florida

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Energy Information Fact Sheet
July 1980
EI-10

Weatherstripping and Caulking to Save Energy

Weatherstripping and Caulking to Save Energy

Faye T. Plowman*

Florida Cooperative Extension Service / Institute of Food and Agricultural Sciences / University of Florida / J. T. Woeste, Dean

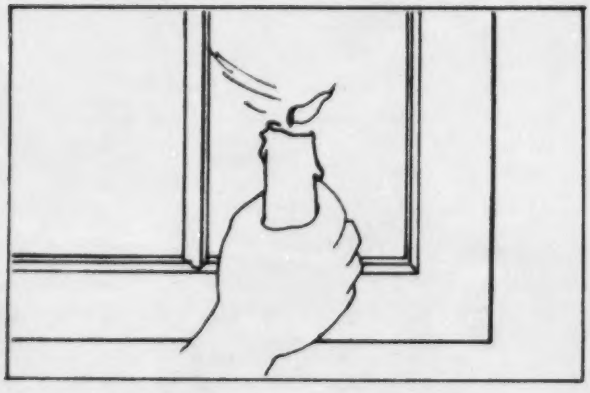
In a well-insulated house, air leakage is the greatest cause of wasted heating and cooling energy. By sealing unnecessary openings and cracks with weatherstripping and caulking, you can prevent energy waste, lower your fuel bills, keep out moisture, and have a cleaner, quieter home. Both weatherstripping and caulking are low in cost, easy for the do-it-yourselfer, and can contribute to substantial savings. They are important steps in both old and new construction to assure yourself of a comfortable home.

AIR LEAKAGE CHECK

If someone punched a hole 10 inches long and 3 inches wide through the wall of your house, you would plug it with anything you could find. If you didn't, you would have an opening of 30 square inches. Yet some homeowners ignore the waste caused by a 1/8-inch crack around a normal-sized outside door, a roughly equal area.

Check the outside doors of your home to see if there are cracks where a door fits the frame or where a frame meets the wall. Look along the edges of the door and frame, both inside and outside the house. Do the same for windows and frames.

On a windy day, use a lighted candle to help you find small leaks. Slowly move the candle along the door and window frames. If the flame flickers, you've found a leak.



Use this checklist as you make your air leakage inspection tour:

___ Front door
___ Back door
___ Door to an attached garage
___ Door to the attic
___ Other door to the outside
___ Kitchen windows
___ Living room windows
___ Bathroom windows
___ Bedroom windows
___ Dining room windows

TOOLS NEEDED

Besides weatherstripping materials and caulking compounds, you will need these simple tools:

- Hammer and nails
- Scissors or tin snips
- Screwdriver
- Steel measuring tape
- Caulking gun
- Putty knife

WEATHERSTRIPPING

There are many types of weatherstripping available, either by the foot or in kits complete with seal and fasteners. The more common types of weatherstripping are made of felt, plastic foam, metal and vinyl.

Measure around each window and door to find out how much weatherstripping is needed. When you buy the weatherstripping in a kit, make sure it is suitable in type and size for installation around your door or window. Cost, ease of application, appearance, and durability should be considered. Follow specific instructions for installation given on the package.

Some of the common types of weatherstripping materials are described in the following table.

*This fact sheet was prepared by Faye T. Plowman, IFAS Associate Professor/Extension Housing Specialist. T. C. Skinner, P.E., IFAS Agricultural Engineering Professor Emeritus, acted as a consultant.

Table 1. Weatherstripping for Doors and Windows

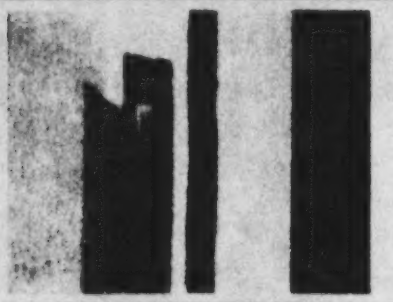
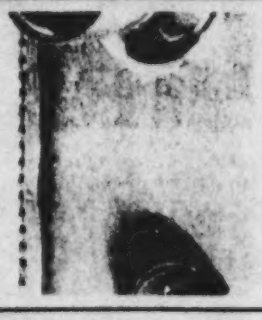
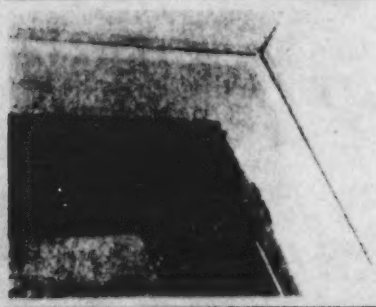
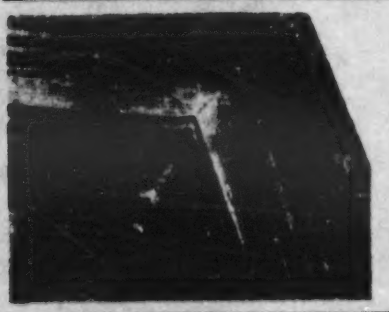
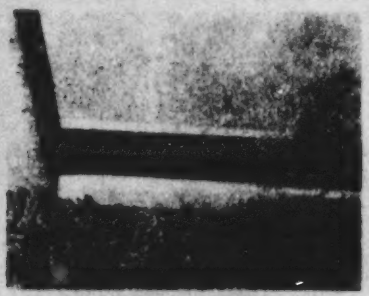
	TYPE	USE	ADVANTAGES & DISADVANTAGES
	Felt	Tacked or stapled to fill the gap where window or door meets the framework.	Inexpensive; easy to install. Temporary; can't be used where parts slide against it.
	Felt-metal strips	Felt in metal strips nailed around door or window frame to seal gaps.	Inexpensive; not very attractive. Fairly durable. Can't be used where parts slide against it.
	Plastic or rubber foam	Adhesive-backed foam strips fasten to framework of door or window.	Inexpensive; easy to install. Sticks well to clean wood or metal. Not very durable.
	Spring metal strips	Spring-activated bronze or aluminum strips nailed around door frame.	Fairly expensive; easy to install. Permanent; creates a tight seal.
	Tubular vinyl gasket	Vinyl stripping with lip that nails to door or window frame.	Inexpensive; easy to install. Use on hard-to-seal areas, uneven doors or loose windows. Durable.

Table 2. Weatherstripping for Bottoms of Doors

	TYPE	USE	ADVANTAGES & DISADVANTAGES
	Metal and vinyl bottom strip	Metal part screws or nails to bottom of door; vinyl part seals door/floor gap.	Extremely durable, easy to install.
	Metal threshold with vinyl gasket	Vinyl gasket seals space between floor and closed door.	Effective when installed properly. Metal is permanent; vinyl gasket may be replaced.

CAULKING

Caulking compounds are available in disposable cartridges made to be used with a caulking gun. Compounds also are sold in gallon and 5-gallon cans. Some compounds come in rope form, which you unwind and force into cracks with your fingers, or in squeeze tubes, which work like toothpaste tubes. Because each of the many different caulking compounds is designed for a specific use, be careful to choose the right one for the job. Also, be sure you have the right color for the job you're doing--caulking comes in white, gray, black and other colors. The most popular types are packaged in individual containers to be used with a caulking gun.

A description of the material, its performance quality, and directions for application are usually printed on each container. Follow instructions on the container for proper installation.

Caulking compounds should be selected on the basis of their ability to adhere to other materials such as wood, glass, metal, plaster, or masonry, since these materials expand and contract. Resistance to weathering, cracking, shrinkage, water and mildew are also important. Some manufacturers state the life expectancy of their product if properly installed inside or outside the home.

Caulking compounds of high quality and long life expectancy are generally highest in cost. In the long run, however, it will pay to base your selection on performance characteristics rather than purchase price alone.

One of the synthetic, flexible or water-base caulking products will best serve the needs of most homeowners. Table 3 lists most common caulking compounds and their characteristics.

The time to caulk is during spring or fall. Below 40°F (4°C), caulking may not cure properly, and condensation of moisture can prevent a solid bond. All types of caulking should be applied over solid, completely dry material. Before applying caulking, thoroughly clean paint build-up, dirt, or deteriorated caulking from the area. Large cracks, over 3/16 of an inch, should be filled to within ¼ inch of the surface with a backup material such as oakum or polystyrene rope. If you are using a caulking gun, hold it at a 45° angle and slant the base of the gun in the direction you are moving.

Paint thinner can be used as a cleaner for all materials except acrylic latex. Follow instructions on the caulking container for clean-up details.

Caulking is needed wherever two different materials or parts of the house meet. Check your home for necessary caulking or caulking repairs:

_____ At joints around window and door frames and siding
_____ Between the foundation and house siding
_____ Between masonry or concrete parts (steps, porches, ect.) and the main part of a house
_____ Where the chimney or masonry meets siding
_____ Around outside water faucets
_____ Where pipes and wires penetrate the ceiling below the attic

Table 3. Uses and Properties of Common Sealing Materials

MATERIAL	RECOMMENDED USES	CLEAN-UP SOLVENT	SHRINKAGE	ADHESION	REMARKS
Silicone	Seals joints between bath and kitchen fixtures and tile; adhesive for tiles and metal fixtures; seals metal joints as in plumbing and gutters. Seals most dissimilar building materials (i.e., wood and stone; metal flashing and brick).	Dry cloth will remove if area is cleaned up immediately. Use mineral spirits, naphtha or paint thinner.	Little or none	Good to excellent	Readily available. Remains flexible for life. Permits joints to stretch or compress. Silicones will stick to painted surfaces, but paint will not adhere to cured silicone. Cost: High
Butyl Rubber	Seals most dissimilar materials glass, metal, plastic, wood, concrete; Seals around windows and flashing, or bonds loose shingles.	Use mineral spirits, naphtha or paint thinner.	Minimal	Good to excellent	Less resilient than silicone. Allows for joint movement but does not become brittle with age. Can be painted after a skin forms. Apply when temperature is above 40° F. Cost: High
Latex	Seals joints around tub and shower; fills cracks in tile, plaster, glass, and plastic; fills nail-holes.	Use water.	Minimal	Good to excellent, except to metal	Easy to use. Seams can be trimmed or smoothed with moist finger or tool. Good water resistance when dry. Can be sanded and painted. Less elastic than above materials. Easy to clean up. Cost: Moderate
Oil-Base Caulks	Seals exterior seams and joints on building materials	Use mineral spirits, naphtha or paint thinner.	Shrinks when dry.	Good	Readily available. Least expensive of the four types. Rope and tube form. Oils dry out and cause material to harden and fall out. Cost: Low

SOURCE: Agriculture Fact Sheet 2-3-2, USDA.

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